Review$_3$: *Final Exam*

Name: _____

1. Water of Hydration

Nickel chloride, $NiCl_2 \cdot x\ H_2O$, is an example of an ionic solid containing water of hydration. ["x" represents some integer value.] Heating the hydrate will drive the water of crystallization out of the solid, leaving behind the anhydrous compound, $NiCl_2$.

Your task is to determine the percent of water in this hydrated compound, and to discover the actual formula for this hydrated solid, including the water of hydration in the formula. You will, of course, need to show all your work.

Data Table

Mass of test tube plus hydrated compound ($NiCl_2 \cdot x\ H_2O$) before heating	28.81 g
Mass of test tube plus anhydrous compound ($NiCl_2$) after heating	25.90 g
Mass of empty test tube	22.41 g

Calculations (Show set-ups)

a. mass of hydrated compound

6.40 g

b. mass of anhydrous compound (after heating)

3.49 g

c. mass of water

2.91 g

d. % (by mass) of water in compound

45.5 %

e. formula of compound (including water as water of crystallization)

$NiCl_2 \cdot$ __**6**__ H_2O

2. Suppose that you lowered the temperature of a gas from 100˚C to 50 ˚C. By what factor do you change the volume of the gas?

The gas will drop to approximately 90% of its old volume.

3. Suppose that 25.0 mL of a gas at 725 mm Hg and 20˚C is converted to standard pressure and temperature. What would be the new volume?

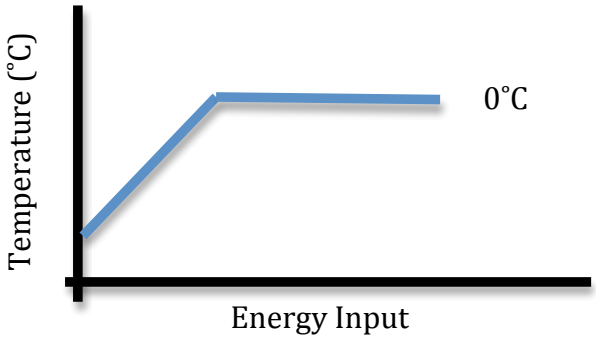
22 mL

4. A student takes a 575 g block of ice at -66˚C and heats it until exactly half of the ice melts.

Energy constants (H_2O)

334 J/g	Heat of fusion (melting or freezing) H_f	**$Q = m\ C\ (T_f - T_i)$**
2260 J/g	Heat of vaporization (evaporating or condensing) H_V	
31.3 J/g˚C	Heat capacity (c) of water vaport	**$Q = m\ H$**
2.1 J/g˚C	Heat capacity (c) of solid water	
4.18 J/g˚C	Heat capacity (c) of liquid water	

a. Sketch in the heating curve of water, and label the beginning and ending points of the problem.



b. How much total energy is involed in the heating and melting described above?

79.7 kJ to heat the ice
96.0 kJ to melt half the ice
180 kJ total energy used.

5. How many molecules of carbon tetrachloride do you have if you have 104 g of carbon tetrachloride?

4.07×10^{23} molecules of CCl_4

6. Write proper names for each formula. Write proper formulas for each name.

Formula	Name		Name	Formula
N_2O	**Dinitrogen monoxide**		Iron (II) acetate	**$Fe(C_2H_3O_2)_2$**
$MnCl_5$	**Manganese (V) chloride**		Hydrosulfuric acid	**H_2S**
$H_2C_2O_3$	**Acetic acid**		Disulfur pentoxide	**S_2O_5**

7. Identify the reaction type for each of the equations below:

Reaction	Type of Reaction
a. $C_6H_{12}O_6 \rightarrow C_{(s)} + H_2O_{(g)}$	**Decomposition**
b. $Al_{(s)} + O_{2(g)} \rightarrow Al_2O_{3(s)}$	**Synthesis**
c. $NaOH_{(aq)} + H_2CO_{3(aq)} \rightarrow NaHCO_{3(aq)} + H_2O_{(l)}$	**Double Replacement**
d. Magnesium metal reacts with hydrochloric acid to produce magnesium chloride and hydrogen gas	**Single Replacement**
e. Iron is left outside in the air to produce iron (III) oxide.	**Synthesis**